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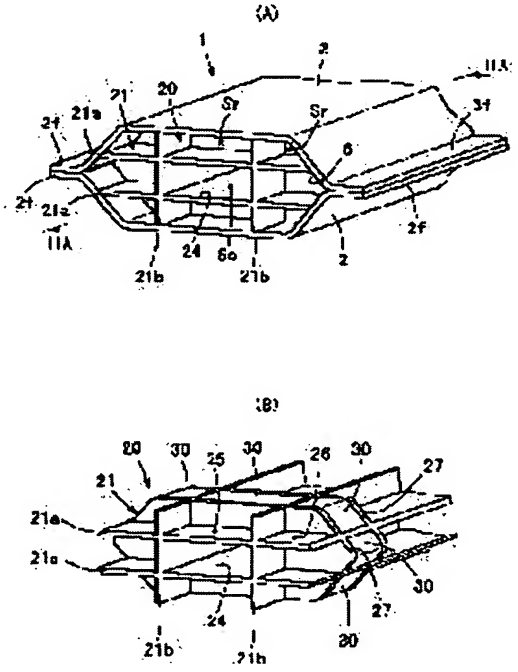
(54) REINFORCING TOOL AND REINFORCING METHOD FOR HOLLOW STRUCTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a reinforcing tool for a hollow structure capable of efficiently reinforcing the hollow structure from the inside.

SOLUTION: This reinforcing tool 20 for the hollow structure 1 is arranged in the hollow section 6 of the hollow structure 1 to reinforce the hollow structure 1. The reinforcing tool 20 is provided with a reinforcing member 21 having partition walls 21a, 21b extending in the longitudinal direction of the hollow section 6 to partition the hollow section 6 into a plurality of split chambers Sc, Sr on the cross section and a foaming base material 30 foamed into a foamed body to cut off at least one split chamber Sr within a plurality of split chambers Sc, Sr. The hollow structure 1 is reinforced nearly uniformly in the width direction and the vertical direction by a plurality of split chambers Sc, Sr and the foam body. Since the foaming base material 30 is foamed in the split chamber the positioning of the foamed body is facilitated.



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CLAIMS

[Claim(s)]
[Claim 1] The reinforcement implement of the hollow structure characterized by having the reinforcement member which has the bridgewall which is the reinforcement implement of the hollow structure with which it is arranged in the centrum of the hollow structure and the hollow structure is reinforced, is prolonged in the longitudinal direction of said centrum, and divides the centrum into two or more division rooms on the cross section, and the fizz base material which intercepts at least one division room among said two or more division rooms by foaming and becoming foam.
[Claim 2] It is the reinforcement implement of the hollow structure characterized by combining the internal surface and reinforcement member of the hollow structure by foaming to a fizz base material in the reinforcement implement of the hollow structure indicated by claim 1, and becoming foam.
[Claim 3] It is the reinforcement implement of the hollow structure characterized by at least one fizz base material being a different class from other fizz base materials among the fizz base materials for intercepting two or more division rooms in the reinforcement implement of the hollow structure indicated by claim 1.
[Claim 4] The reinforcement implement of the hollow structure characterized by having the horizontal wall which is the reinforcement implement of the hollow structure with which it is arranged in the centrum of the hollow structure and the hollow structure is reinforced, is prolonged in the longitudinal direction of said centrum, is established in the reinforcement member which has the bridgewall which divides a centrum into two or more division rooms on the cross section, and the direction which intersects said bridgewall, and divides a centrum into two or more division rooms in the longitudinal section.
[Claim 5] It is the reinforcement implement of the hollow structure which is the reinforcement implement of the hollow structure with which it is arranged in the centrum of the hollow structure and the hollow structure is reinforced, was prolonged in the longitudinal direction of said centrum, is equipped with the reinforcement member which has the bridgewall which divides the centrum into two or more division rooms on the cross section, and is characterized by constituting a reinforcement member with the division object divided into plurality on the cross section.
[Claim 6] A reinforcement member is the reinforcement implement of the hollow structure with which it is characterized by the configuration of the cross section being an abbreviation lattice type in the reinforcement implement of the hollow structure given in either of claim 1 to claims 5.
[Claim 7] The reinforcement approach of the hollow structure characterized by to have the process which fabricates the reinforcement member which has the bridgewall which is prolonged in the longitudinal direction of the centrum of the hollow structure, and divides the centrum into two or more division rooms on the cross section, the process which arrange the reinforcement member in the centrum of the hollow structure, and the process which intercept a division room by the foam which the fizz base material was made to foam among two or more division rooms at at least one division room, and was obtained by the foaming.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the reinforcement implement of the hollow structure with which it is arranged in the centrum of the hollow structures, such as a frame of a car, and a pillar, and the hollow structure is reinforced.
[0002]
[Description of the Prior Art] In recent years, as for the body of a car etc., the thinning of a griddle is progressing for lightweight-izing. However, since reinforcement falls by the thinning of a griddle, in the hollow structures 120 (refer to drawing 7 (A)), such as a frame of a car, and a pillar, the method of raising (the drawing 7 (C) reference) and reinforcement selectively is suitably used by filling up with rigid high foam 123 the centrum of the part for which reinforcement is needed, or welding to it on both sides of the (drawing 7 (B) reference) or the back up plate 124.
[0003]
[Problem(s) to be Solved by the Invention] However, it is difficult to position foam 123 in the location of choice by the approach of filling up a centrum with rigid high foam 123, and the reinforcement effectiveness of the hollow structure 120 is low. Moreover, by the approach of welding on both sides of the back up plate 124, the reinforcement of a lengthwise direction becomes low to crosswise reinforcement, and the reinforcement effectiveness of the hollow structure 120 is low too.
[0004] This invention is made in view of the above-mentioned trouble, and aims at offer of the reinforcement implement with which the hollow structure can be reinforced more efficiently than before.
[0005]
[Means for Solving the Problem] The above-mentioned technical problem is solved by invention of each claim. According to invention of claim 1, the centrum of the hollow structure is divided into two or more division rooms on the cross section with the bridgewall of a reinforcement member. Furthermore, at least one division room is intercepted by a fizz base material foaming and becoming foam among two or more division rooms. For this reason, the hollow structure is reinforced with two or more division rooms and work of foam almost uniformly in the cross direction and a lengthwise direction. Moreover, positioning of foam also becomes easy in order to foam to a fizz base material in the division interior of a room. That is, the hollow structure is efficiently reinforced by a division room and foam from the inside.
[0006] According to invention of claim 2, since a fizz base material combines the internal surface and reinforcement member of the hollow structure by foaming and becoming foam, it does not occur [backlash] between the hollow structure and a reinforcement member.
[0007] According to invention of claim 3, at least one fizz base material is a different class from other fizz base materials among the fizz base materials for intercepting two or more division rooms. For this reason, for example, it becomes possible not only reinforcement of the hollow structure but to aim at improvement in vibration resistance, and improvement in insulation.
[0008] Since according to invention of claim 4 the centrum of the hollow structure is divided into two or more division rooms on the cross section with the bridgewall of a reinforcement member and a centrum is further divided into two or more division rooms in the longitudinal section with a

horizontal wall, the hollow structure can be reinforced with balance sufficient to a longitudinal direction and the cross direction.
[0009] According to invention of claim 5, since a reinforcement member is constituted by the division object divided into plurality on the cross section, when the cross-section configuration of the reinforcement member is complicated, a fabrication becomes easy rather than it really fabricates a reinforcement member. Furthermore, also when the hollow structure curves to a longitudinal direction, a reinforcement member can be fabricated according to the deflection of the hollow structure.
[0010] According to invention of claim 6, since the configuration of the cross section is an abbreviation lattice type, a reinforcement member does not start the cross-section configuration of the hollow structure, but can be reinforced with sufficient balance.
[0011] According to invention of claim 7, the centrum of the hollow structure is divided into two or more division rooms on the cross section with the bridgewall of a reinforcement member. Furthermore, at least one division room is intercepted by a fizz base material's foaming and becoming foam among two or more division rooms. For this reason, the hollow structure is efficiently reinforced by work of two or more division rooms and a fizz base material from the inside.
[0012]
[Embodiment of the Invention] (Gestalt of the first operation) Based on drawing 1 - drawing 3 , the reinforcement implement of the hollow structure concerning the gestalt of operation of the first of this invention is explained hereafter. The reinforcement implement of the hollow structure concerning the gestalt of this operation is related with the reinforcement implement of the hollow structures, such as a pillar of the car body, a rocker panel, and a roof side panel. Here, the perspective view and drawing 1 (B) with which drawing 1 (A) expresses a mounting beam condition for a reinforcement implement to the hollow structure are [the IIA-IIA view sectional view of drawing 1 (A) and drawing 2 (B) of the important section perspective view of the reinforcement implement and drawing 2 (A)] the B-B view sectional views of drawing 2 (A). Moreover, the IIA-IIA view sectional view of drawing 1 (A) after a fizz base material foams to drawing 3 (A), and drawing 3 (B) are the B-B view sectional views of drawing 3 (A).
[0013] As the hollow structure 1 is shown in drawing 1 (A), it consists of the inner panels 2 and the outer panels 3 of cross-section abbreviation trapezoidal shape, and the cross-section abbreviation hexagon-like centrum 6 is formed by carrying out spot welding of the inner panel 2 and outer panel 3 by the mutual flanges 2f and 3f. Moreover, in the centrum 6 of the hollow structure 1, the reinforcement implement 20 with which the hollow structure 1 is reinforced in a predetermined location is attached.
[0014] The reinforcement implement 20 is equipped with the reinforcement member 21 of the predetermined linear dimension which reinforces the hollow structure 1 from the inside in order to prevent deformation of the hollow structure 1. The reinforcement member 21 is fabricated by putting together horizontal bridgewall 21a of a couple and vertical bridgewall 21b of a couple which are prolonged in the longitudinal direction of the hollow structure 1 in the shape of a grid, as shown in drawing 1 (B). Thus, since horizontal bridgewall 21a and vertical bridgewall 21b are together put in the shape of a grid, a square case section 24 is formed in the center of the reinforcement member 21 at a longitudinal direction, and the four U-shaped-gutter sections 25 and four L character slots 26 are formed in the perimeter of the square case section 24.
[0015] And when the reinforcement member 21 is contained by the hollow structure 1, as shown in drawing 1 (A), the central division room Sc by the square case section 24 of the reinforcement member 21 and the eight perimeters division room Sr by the U-shaped-gutter section slot 26 of 25 or L characters of the reinforcement member 21 are formed in the interior of the hollow structure 1. That is, the centrum 6 of the hollow structure 1 is divided into the eight perimeters division room Sr formed in the surroundings of the central division room Sc which extends in a longitudinal direction by the reinforcement member 21, and its central division room Sc.
[0016] The holder plate 27 of the couple which crosses the U-shaped-gutter section slot 26 of 25 or L characters in a longitudinal direction predetermined location is being fixed to the perimeter of the square case section 24 of the reinforcement member 21 in the shape of a flange. And the fizz base

material 30 which carries out a postscript is set to each crevice formed by those holder plates 27 and U-shaped-gutter sections 25, or the L character slot 26. The holder plate 27 is a member which regulates the foaming direction, as the fizz base material 30 carries out foaming expansion in the crossing direction of the hollow structure 1, and it is equipped with the engagement member (not shown) which fixes the fizz base material 30 to the predetermined location.

[0017] It is fabricated by the configuration where the appearance of the holder plate 27 is almost equal to the cross-section configuration of the centrum 6 of the hollow structure 1, and the dimension is set as the dimension which a proper clearance (clearance which is extent which can pass a coating) produces between the inner circle wall sides of a centrum 6 (refer to drawing 2 (A) and (B)).

[0018] The stop clip 29 for fixing the reinforcement member 21 to anchoring hole 2k of the inner panel 2 is formed in longitudinal direction both sides at the soffit section of the reinforcement member 21. 29d of plinth sections connected to vertical bridgewall 21b of the reinforcement member 21 as the stop clip 29 was shown in drawing 2 (A), It has 29t of elastic stop pieces which extend in the shape of a clinch and engage with anchoring hole 2k elastically from the point both sides of leg 29a which projects from the underside of 29d of the plinth section, and is prolonged in the direction of an alignment of anchoring hole 2k of the inner panel 2, and its leg 29a. Here, the location of the stop clip 29 of anchoring hole 2k of the inner panel 2 and the reinforcement member 21 is set as the location where the square case section 24 of the reinforcement member 21 serves as this alignment mostly with the centrum 6 of the hollow structure 1. In addition, although the example which formed the stop clip 29 in the longitudinal direction both sides of the reinforcement member 21 was shown in drawing 2 (A), in consideration of the support balance of the reinforcement member 21, you may form in a location suitably the middle.

[0019] Generally the reinforcement member 21, the holder plate 27, and stop clip 29 grade are really fabricated by injection molding of resin. In addition, the division object divided into plurality on the cross section may constitute the reinforcement member 21. Here, as an ingredient of reinforcement member 21 grade, the hard synthetic resin which has thermal resistance, and the hard synthetic resin with which consolidation fiber was mixed desirably are used suitably. As hard synthetic resin, a polyamide (PA), polypropylene (PP), polyethylene terephthalate (PET), polybutylene terephthalate (PBT), epoxy (EP), an unsaturated polyester resin, etc. are used, for example. Moreover, as consolidation fiber, a glass fiber, carbon fiber, Kevlar fiber, etc. are used, for example. Furthermore, the mixing rate of consolidation fiber to hard synthetic resin is set up to 30 - 40% of the weight. That is, the holder plate 27 of the reinforcement member 21 is equivalent to the horizontal wall of this invention.

[0020] The fizz base material 30 is a member which intercepts the eight perimeters division room Sr by foaming and becoming foam 40, and is fabricated by the configuration which can fit into each crevice formed with the U-shaped-gutter section slot 26 of 25 or L characters of the reinforcement member 21, and the holder plate 27 of a couple. Moreover, the synthetic resin which has an adhesive property to a metal side or a synthetic-resin side as an ingredient of the fizz base material 30 is used as a principal component, fibrous material for a consolidation like a foaming agent and a glass fiber etc. is mixed by this, it foams with the heat at the time of being the baking finish of the car body (for example, temperature around 110 degrees C - 190 degrees C), and the fizz ingredient used as the foam 40 of high rigidity is used suitably.

[0021] Next, the procedure of reinforcing the hollow structure 1 is explained. First, each fizz base material 30 is set to the crevice between the holder plates 27 of the couple fabricated by the reinforcement member 21 and one, and the reinforcement implement 20 is constituted (refer to drawing 1 (B)). Next, the stop clip 29 of the reinforcement implement 20 is inserted in anchoring hole 2k of the inner panel 2, and the reinforcement implement 20 is fixed to the predetermined location of the inner panel 2.

[0022] Next, as spot welding of the inner panel 2 and the outer panel 3 is carried out in the mutual flanges 2f and 3f and they are shown in drawing 1 (A), the cross-section abbreviation hexagon-like hollow structure 1 is formed. In this condition, between the holder plate 27 of a mounting eclipse and its reinforcement implement 20 and the fizz base material 30, and the inner circle wall side of a centrum 6, the clearance which is extent which can pass a coating is formed at the centrum 6 of the hollow structure 1 so that the reinforcement implement 20 may serve as this alignment mostly with

that centrum 6 in a predetermined location (refer to drawing 2 (A) and (B)).
[0023] Thus, shaping of the body of the car which has the hollow structure 1 carries out baking finish of the body. And by the heat tracing in the case of the baking finish, as shown in drawing 3 (A) and (B), each fizz base material 30 of the reinforcement implement 20 carries out foaming expansion, and serves as foam 40. Since the fizz base material 30 is pinched from both sides with the holder plate 27, foaming of the direction where the fizz base material 30 meets the holder plate 27 is promoted effectively. Namely, as for the holder plate 27, for a certain reason, the work which controls the foaming direction can also control the charging efficiency of foam.
[0024] Foam 40 takes up the clearance between the holder plate 27 and the inner circle wall side of the hollow structure 1, and pastes up firmly the foam 40 extruded from the holder plate 27 on the inner circle wall side while pasting the reinforcement member 21 and the holder plate 27 of the reinforcement implement 20. That is, the perimeter division room Sr formed in the centrum 6 of the hollow structure 1 by the reinforcement implement 20 is intercepted by foam 40, and the reinforcement implement 20 is combined with the hollow structure 1 by the foam 40. In addition, foam 40 does not enter the central division room Sc by work of the square case section 24 of the reinforcement implement 20.
[0025] Thus, according to the reinforcement implement 20 of the hollow structure 1 concerning the gestalt of this operation, the centrum 6 of the hollow structure 1 is divided into two or more division rooms Sc and Sr on the cross section with the bridgewalls 21a and 21b of the reinforcement member 21. Furthermore, the perimeter division room Sr is intercepted by the fizz base material 30 foaming and becoming foam 40 among two or more division rooms Sc and Sr. For this reason, the hollow structure 1 is reinforced with two or more division rooms Sc and Sr and work of foam 40 almost uniformly in the cross direction and a lengthwise direction. Moreover, in order to foam to the fizz base material 30 in the perimeter division room Sr in the condition of having been restrained from both sides on the holder plate 27, positioning of foam 40 also becomes easy. That is, the hollow structure 1 is efficiently reinforced by the division rooms Sc and Sr and foam 40 from the inside.
[0026] Moreover, since the fizz base material 30 of the reinforcement implement 20 combines the internal surface of the hollow structure 1, and reinforcement member 21 grade by foaming and becoming foam 40, it does not occur [backlash] between the hollow structure 1 and the reinforcement member 21. Moreover, since the centrum 6 of the hollow structure 1 is divided into two or more division rooms Sc and Sr on the cross section with the bridgewalls 21a and 21b of the reinforcement member 21 and a centrum 6 is further divided into two or more division rooms in the longitudinal section with the holder plate 27, the hollow structure 1 can be reinforced with balance sufficient to a longitudinal direction and the cross direction.
[0027] Moreover, since the configuration of the cross section is an abbreviation lattice type, the reinforcement member 21 does not start the cross-section configuration of the hollow structure 1, but can be reinforced with sufficient balance. Moreover, since the reinforcement member 21 is a product made of resin, it is light compared with the back up plate, such as a griddle, and does not become the increment in weight so much. In addition, although the gestalt of this operation explained the reinforcement implement in the cross-section abbreviation hexagon-like hollow structure 1, the cross-section configurations of the hollow structure 1 may be an abbreviation square, a pentagon, an ellipse form, etc. in addition to an abbreviation hexagon.
[0028] (Gestalt of the second operation) Based on drawing 4 , the reinforcement implement of the hollow structure concerning the gestalt of operation of the second of this invention is explained hereafter. The reinforcement implement of the hollow structure concerning the gestalt of this operation changes arrangement of the fizz base material in the gestalt of the first operation, and other structures are the same as that of the case of the gestalt of the first operation. The reinforcement member 60 concerning the gestalt of this operation equips the perimeter predetermined location of a square case section 64 with three parallel holder plates 67 which cross the U-shaped-gutter section slot 66 of 65 or L characters. And the first fizz base material 72 is contained by the crevice beforehand decided among two or more crevices formed by those holder plates 67 and U-shaped-gutter sections 65, or the L character slot 66.
[0029] That is, in the gestalt of this operation, the first fizz base material 72 is contained by the location of the crevice shown in drawing 4 (C) between the front holder plate 67 and the central

holder plate 67 in drawing 4 (A). Moreover, between the central holder plate 67 and the back holder plate 67, the first fizz base material 72 is contained by the hoop direction by lot gap ****** from the condition of drawing 4 (C). Thus, since the first fizz base material 72 is distributed by the longitudinal direction of the hollow structure 1, the balance at the time of fixing the reinforcement member 60 to the hollow structure 1 by the foam which is not illustrated improves. The same ingredient as the fizz base material 30 used with the gestalt of the first operation as an ingredient of the first fizz base material 72 here is used.

[0030] Moreover, inside the square case section 64 of the reinforcement member 60, as shown in drawing 4 (B) and (C), the second fizz base material 74 is contained. it boils the foam (not shown) markedly rather than the foam (not shown) by the first fizz base material 72, it is the fizz base material to which it foams for a high scale factor, and its reinforcement is [the second fizz base material 74 has small specific gravity, and] also still smaller than the first fizz base material 72. However, the effect of intercepting noise of the hollow structure 1 improves by taking up the interior of the square case section 64 of the reinforcement member 60 with the foam by the second fizz base material 74. moreover, since it is small, even if it is markedly alike, and specific gravity fills up a square case section 64 with foam rather than the foam of the first fizz base material 72, weight does not increase the foam of the second fizz base material 74 so much.

[0031] In addition, although the gestalt of this operation showed the example which makes the longitudinal direction of the hollow structure 1 distribute the first fizz base material 72 using three holder plates 67, it is possible also by the approach of distributing the first fizz base material 72 where a holder plate is detached to a longitudinal direction for each class using two or more sets of holder plates.

[0032] (Gestalt of the third operation) Based on drawing 5 , the reinforcement implement of the hollow structure concerning the gestalt of operation of the third of this invention is explained hereafter. With the gestalt of this operation, a cross-section configuration right-angled to the longitudinal direction of a reinforcement member is changed into a simple lattice type, as shown in drawing 5 (A) and (B), and other structures are the same as that of the reinforcement implement of the hollow structure concerning the gestalt of the first operation. Thus, since the cross-section configuration of the reinforcement member 80 becomes a simple lattice type, lightweight-izing and cost reduction of the reinforcement member 80 can be planned.

[0033] Moreover, as you may really fabricate with injection molding of resin and it is shown in drawing 5 (C) and (D), in case the reinforcement member 80 fabricates the division objects 81, 82, and 83 divided into plurality on the cross section, respectively and sets them to the hollow structure, it may assemble those division objects 81, 82, and 83 by adhesives, joining, etc. Furthermore, the cross-section configuration of the reinforcement member 80 is complicated, and even when injection molding is impossible, the fabrication of the reinforcement member 80 is attained by assembling from the division objects 81, 82, and 83. Moreover, also when the hollow structure curves to a longitudinal direction by assembling the reinforcement member 80 from the division objects 81, 82, and 83, it becomes possible to fabricate the reinforcement member 80 according to the deflection of the hollow structure. In addition, as shown in drawing 5 (D), as shown in drawing 5 (C), it is desirable [the way which forms the reinforcement member 80 combining two division objects 83 of a cross-section T typeface] on stock control rather than it forms the reinforcement member 80 from the division objects 81 and 82 of a different configuration.

[0034] (Gestalt of the fourth operation) Based on drawing 6 , the reinforcement implement of the hollow structure concerning the gestalt of operation of the fourth of this invention is explained hereafter. The reinforcement implement of the hollow structure concerning the gestalt of this operation increases the number of the perimeter division rooms which are made to increase the number of the grids of a reinforcement member, and surround a central division room, and enables it to contain various fizz base materials in a perimeter division room.

[0035] The reinforcement member 100 is fabricated by putting the sides 101-108 of eight sheets, and the vertical boards 111-116 of six sheets together in the shape of a grid. And the sheet metal of the high scale-factor fizz base material 74 to which it foams for the high scale factor used for the central division room Sc formed by the second side 102, the fifth side 105, the third vertical board 113, and the fourth vertical board 114 with the gestalt of the second operation is set.

[0036] The damping fizz base material 117 with which the high (it has elasticity comparatively) foam of damping nature is obtained is set to the outside of the first side 101, the sixth side 106, the first vertical board 111, and the sixth vertical board 116. Moreover, the high rigidity fizz base material 118 with which the foam of high rigidity is obtained is set to the first perimeter division room Sa which is a division room which exists inside the division room 101 which surrounds the central division room Sc by predetermined thickness, i.e., the first side, the sixth side 106, the second vertical board 112, and the fifth vertical board 115, and is located on the outside of the central division room Sc.
[0037] The exoergic fizz base material 119 which generates heat violently at the time of foaming is set to the second perimeter division room Sb located inside the first vertical board 111 on the outside of the first perimeter division room Sa. Moreover, the exoergic fizz base material 119 is set to the third perimeter division room Sc located inside the sixth vertical board 116 on the outside of the first perimeter division room Sa.
[0038] And each fizz base material 74,117,118,119 carries out foaming expansion by the heat tracing at the time of baking finish of the body of the car which has the hollow structure being carried out. That is, if the damping fizz base material 117 located in the outside of the first side 101, the sixth side 106, the first vertical board 111, and the sixth vertical board 116 foams, while the division room between the reinforcement member 100 and the internal surface of the hollow structure will be closed by the foam and the reinforcement member 100 will paste the hollow structure (not shown), the oscillation which joins the hollow structure by the foam can be absorbed to some extent. Moreover, when the high scale-factor fizz base material 74 located in the central division room Sc foams, the central division room Sc is closed by the foam, and the effect of intercepting noise of the hollow structure can be raised, without being accompanied so much by the rise of weight.
[0039] Furthermore, when the high rigidity fizz base material 118 located in the first perimeter division room Sa surrounding the central division room Sc foams, the first perimeter division room Sa is closed by the foam, and the rigidity of the reinforcement member 100 improves. Moreover, when the exoergic fizz base material 119 located in the second perimeter division room Sb and the third perimeter division room Sc foams, the exoergic fizz base material 119 generates heat, and even if the heating temperature in the case of baking finish is low, the damping fizz base material 117, the high scale-factor fizz base material 74, and the high rigidity fizz base material 118 can be made to foam good by the generation of heat.
[0040] In addition, in the gestalt of this operation, although the example which arranges the damping fizz base material 117 on the outside of the high rigidity fizz base material 118 and the exoergic fizz base material 119 was shown, the high rigidity fizz base material 118 and the damping fizz base material 117 may be replaced. Moreover, it is also possible to arrange alternately the high rigidity fizz base material 118, the exoergic fizz base material 119, and the damping fizz base material 117. Furthermore, although the example which uses a solid fizz base material in the gestalt of the third operation from the first was shown, if it enables it to equip with a lid the division room formed of the grid of a reinforcement member, it is also possible to use the fizz base material of powder, grain, or a liquid. It becomes unnecessary to take into consideration the shaping precision of a fizz base material by this.
[0041] Moreover, although the gestalt of the fourth operation showed the example which uses the reinforcement implement of this invention from the first to the hollow structures, such as a rocker panel of the car body, and a roof sand panel, it is also possible to use the reinforcement implement of this invention for the hollow structure which constitutes buildings, such as a building except the car body and a marine vessel.
[0042] In addition, it is invention grasped according to the gestalt of the fourth operation from the gestalt of the first operation, and invention which is not indicated by the claim is added to below.
1) Foam to the fizz base material contained inside a reinforcement member for a high scale factor in claim 3 rather than the fizz base material for combining the internal surface and reinforcement member of the hollow structure. For this reason, the specific gravity of the foam inside a reinforcement member can become small, and the effect of intercepting noise of the hollow structure can be raised, without being accompanied so much by weight rise.
2) In claim 3, at least one fizz base material has the febrility higher than other fizz base materials at

the time of foaming among the fizz base materials for intercepting two or more division rooms. For this reason, even if the heating temperature in the case of baking finish is low, other fizz base materials can be made to foam good.
3) In claim 3, at least one fizz base material has the high rigidity of the foam obtained rather than other fizz base materials among the fizz base materials for intercepting two or more division rooms. For this reason, the rigidity of a reinforcement member improves.
4) In claim 3, at least one fizz base material has the large resiliency of the foam obtained rather than other fizz base materials among the fizz base materials for intercepting two or more division rooms. For this reason, the oscillation which joins the hollow structure is absorbable to some extent.
5) In claim 4, it has the fizz base material which intercepts at least one division room among two or more division rooms by foaming and becoming foam. For this reason, the hollow structure can be reinforced with balance sufficient to a longitudinal direction and the cross direction by the reinforcement member and foam.
[0043]
[Effect of the Invention] According to this invention, the hollow structure is reinforced with two or more division rooms and work of foam almost uniformly in the cross direction and a lengthwise direction. Furthermore, positioning of foam also becomes easy in order to foam to a fizz base material in the division interior of a room. That is, the hollow structure is efficiently reinforced by a division room and foam from the inside.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view (A drawing) and the important section perspective view (B drawing) of a reinforcement implement showing the anchoring condition of the reinforcement implement of the hollow structure concerning the gestalt of operation of the first of this invention.
[Drawing 2] It is the B-B view sectional view (B drawing) of the IIA-IIA view sectional view (A drawing) of drawing 1 (A), and A drawing.
[Drawing 3] It is the B-B view sectional view (B drawing) of the IIA-IIA view sectional view (A drawing) showing the condition after foaming of drawing 1 (A), and A drawing.
[Drawing 4] It is the C-C view sectional view (C drawing) of the important section perspective view (A drawing) of the reinforcement implement of the hollow structure concerning the gestalt of operation of the second of this invention, drawing of longitudinal section (B drawing) which expresses a mounting beam condition to the hollow structure, and B drawing.
[Drawing 5] They are cross-section configuration drawing (A drawing, B drawing) of the reinforcement member in the reinforcement implement of the hollow structure concerning the gestalt of operation of the third of this invention, and cross-section configuration drawing (C drawing, D drawing) of the division object which constitutes a reinforcement member.
[Drawing 6] It is cross-section configuration drawing in the reinforcement implement of the hollow structure concerning the gestalt of operation of the fourth of this invention.
[Drawing 7] They are the perspective view (A drawing) of the conventional hollow structure, and a perspective view (B drawing, C drawing) showing the condition of having equipped the hollow structure with the reinforcement implement.
[Description of Notations]
Sc Central division room
Sr Perimeter division room
1 Hollow Structure
20 Reinforcement Implement
21 Reinforcement Member
21a Horizontal bridgewall
21b Vertical bridgewall
27 Holder Plate (Horizontal Wall)
30 Fizz Base Material
40 Foam
74 High Scale-Factor Fizz Base Material
117 Damping Fizz Base Material
118 High Rigidity Fizz Base Material
119 Exoergic Fizz Base Material

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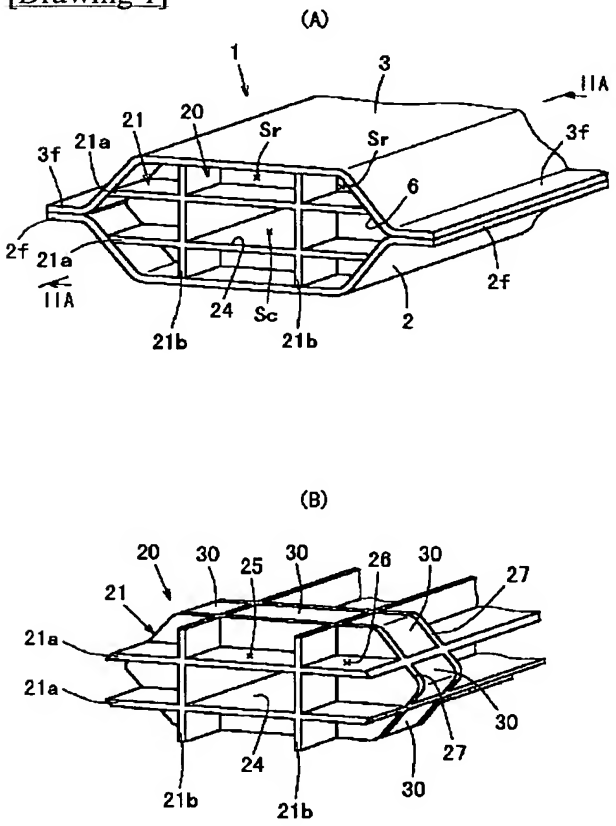
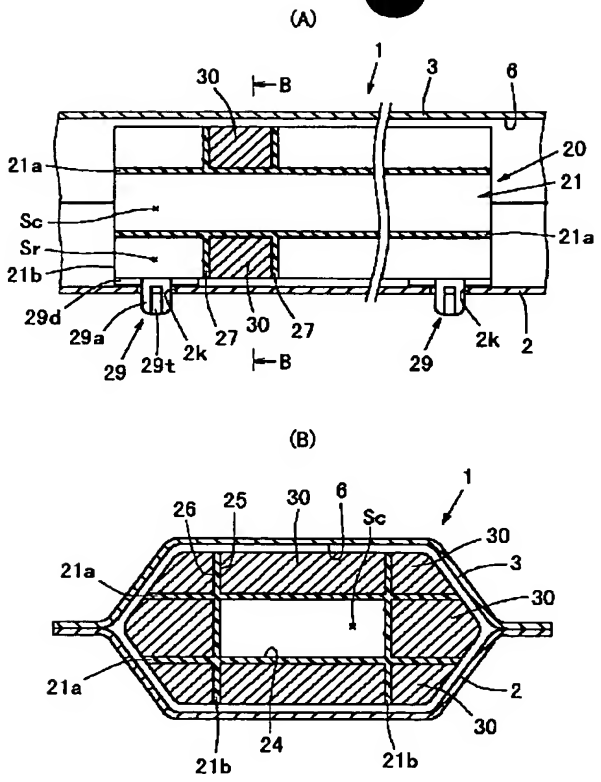
DRAWINGS

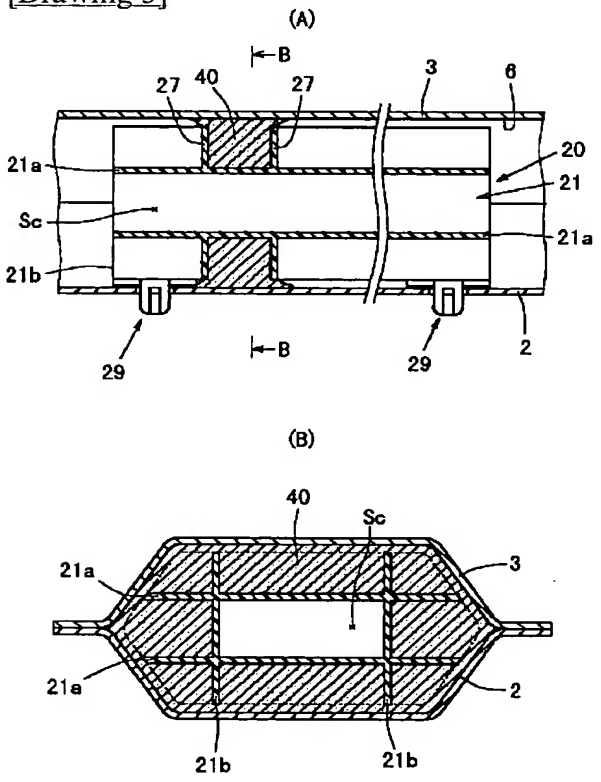
[Drawing 1]



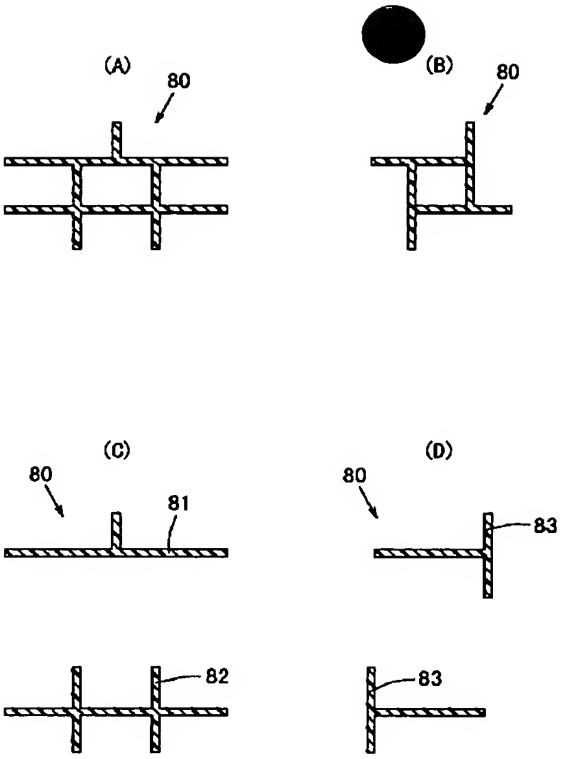
[Drawing 2]



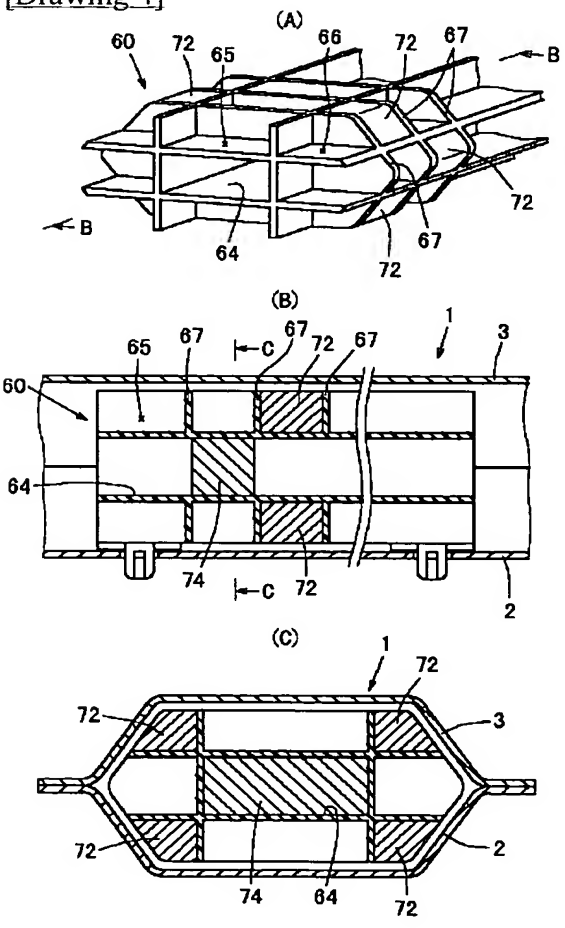
[Drawing 3]



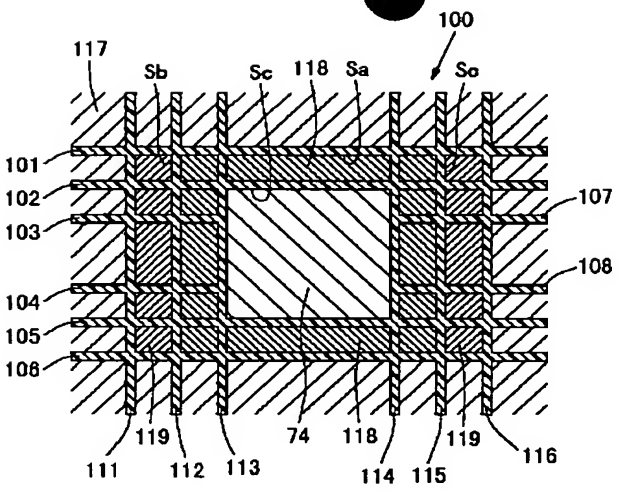
[Drawing 5]



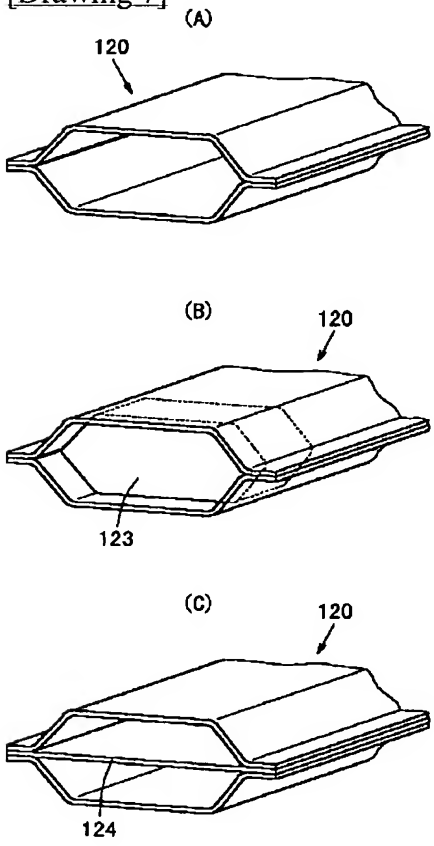
[Drawing 4]



[Drawing 6]



[Drawing 7]



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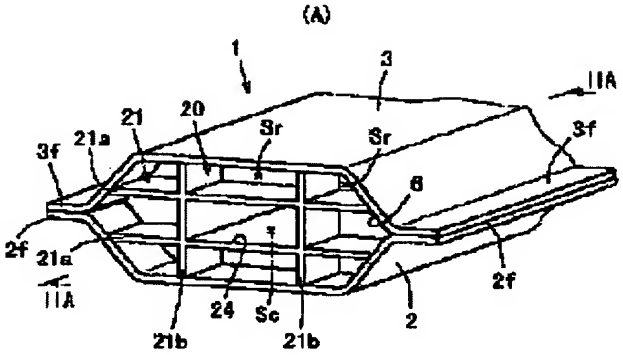
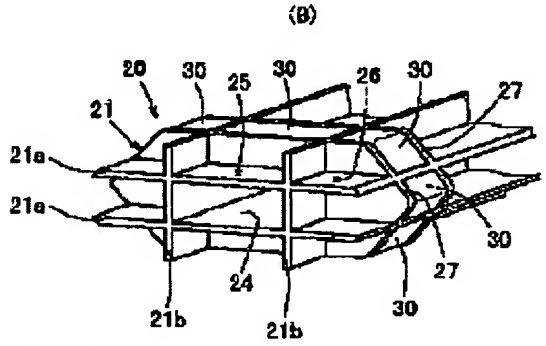
REINFORCING TOOL AND REINFORCING METHOD FOR HOLLOW STRUCTURE

Patent number:	JP2001191949
Publication date:	2001-07-17
Inventor:	MATSUKI NOBUAKI
Applicant:	NEOEX LAB INC
Classification:	
- international:	B62D25/04; B62D29/04
- european:	
Application number:	JP20000001858 20000107
Priority number(s):	JP20000001858 20000107

Abstract of **JP2001191949**

PROBLEM TO BE SOLVED: To provide a reinforcing tool for a hollow structure capable of efficiently reinforcing the hollow structure from the inside. SOLUTION: This reinforcing tool 20 for the hollow structure 1 is arranged in the hollow section 6 of the hollow structure 1 to reinforce the hollow structure 1. The reinforcing tool 20 is provided with a reinforcing member 21 having partition walls 21a, 21b extending in the longitudinal direction of the hollow section 6 to partition the hollow section 6 into a plurality of split chambers Sc, Sr on the cross section and a foaming base material 30 foamed into a foamed body to cut off at least one split chamber Sr within a plurality of split chambers Sc, Sr. The hollow structure 1 is reinforced nearly uniformly in the width direction and the vertical direction by a plurality of split chambers Sc, Sr and the foam body. Since the foaming base material 30 is foamed in the split chamber the positioning of the foamed body is facilitated.





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29/04		29/04	Ｂ	

審査請求　未請求　請求項の数７　ＯＬ　（全８頁）

(21)出願番号　特願2000－1858(P2000－1858)

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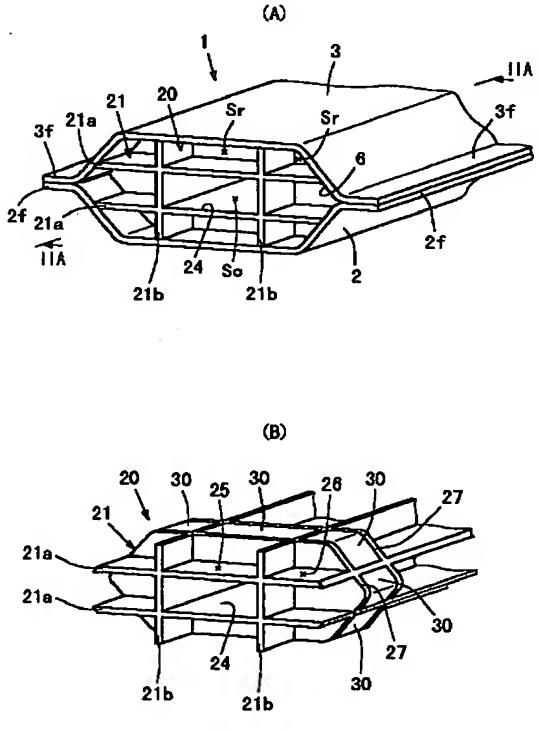
Ｆターム(参考)　3D003 AA01 BB01 CA17 CA32 CA36

(54)【発明の名称】　中空構造物の補強具及び補強方法

(57)【要約】
【課題】　中空構造物を内側から効率的に補強できる中空構造物の補強具を提供する。
【解決手段】　本発明は、中空構造物１の中空部６に配設されてその中空構造物１を補強する中空構造物１の補強具２０であって、中空部６の長手方向に延び、その中空部６を横断面において複数の分割室Ｓｃ，Ｓｒに仕切る仕切り壁２１ａ，２１ｂを有する補強部材２１と、発泡して発泡体となることで、複数の分割室Ｓｃ，Ｓｒのうち少なくとも一つの分割室Ｓｒを遮断する発泡性基材３０とを備えている。このため、中空構造物１は複数の分割室Ｓｃ，Ｓｒ及び発泡体の働きで幅方向及び縦方向にほぼ均等に補強される。また、発泡性基材３０は分割室内で発泡するため、発泡体の位置決めも容易になる。



【特許請求の範囲】
【請求項１】　中空構造物の中空部に配設されてその中空構造物を補強する中空構造物の補強具であって、
前記中空部の長手方向に延び、その中空部を横断面において複数の分割室に仕切る仕切り壁を有する補強部材と、
発泡して発泡体となることで、前記複数の分割室のうち少なくとも一つの分割室を遮断する発泡性基材と、を備えていることを特徴とする中空構造物の補強具。
【請求項２】　請求項１に記載された中空構造物の補強具において、
発泡性基材は、発泡して発泡体となることで中空構造物の内壁面と補強部材とを結合させることを特徴とする中空構造物の補強具。
【請求項３】　請求項１に記載された中空構造物の補強具において、
複数の分割室を遮断するための発泡性基材のうち少なくとも一つの発泡性基材は、他の発泡性基材と異なる種類であることを特徴とする中空構造物の補強具。
【請求項４】　中空構造物の中空部に配設されてその中空構造物を補強する中空構造物の補強具であって、
前記中空部の長手方向に延び、中空部を横断面において複数の分割室に仕切る仕切り壁を有する補強部材と、
前記仕切り壁と交差する方向に設けられ、中空部を縦断面において複数の分割室に仕切る横壁と、を有することを特徴とする中空構造物の補強具。
【請求項５】　中空構造物の中空部に配設されてその中空構造物を補強する中空構造物の補強具であって、
前記中空部の長手方向に延び、その中空部を横断面において複数の分割室に仕切る仕切り壁を有する補強部材を備えており、
補強部材は、その横断面において複数に分割された分割体により構成されることを特徴とする中空構造物の補強具。
【請求項６】　請求項１から請求項５のいずれかに記載の中空構造物の補強具において、
補強部材は、その横断面の形状が略格子形であることを特徴とする中空構造物の補強具。
【請求項７】　中空構造物の中空部の長手方向に延び、その中空部を横断面において複数の分割室に仕切る仕切り壁を有する補強部材を成形する工程と、
その補強部材を中空構造物の中空部に配設する工程と、
複数の分割室のうち少なくとも一つの分割室で発泡性基材を発泡させて、その発泡により得られた発泡体で分割室を遮断する工程と、を備えることを特徴とする中空構造物の補強方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、車両のフレーム、ピラー等の中空構造物の中空部に配設されてその中空構造物を補強する中空構造物の補強具に関する。
【０００２】
【従来の技術】近年、車両のボディ等は軽量化のため鉄板の薄肉化が進んでいる。しかし、鉄板の薄肉化により強度が低下するため、車両のフレーム、ピラー等の中空構造物１２０（図７（Ａ）参照）では、強度が必要とされる部位の中空部に剛性の高い発泡体１２３を充填したり（図７（Ｂ）参照）、あるいは補強板１２４を挟んで溶接することにより（図７（Ｃ）参照）、強度を部分的に向上させる方法が好適に使用されている。
【０００３】
【発明が解決しようとする課題】しかし、中空部に剛性の高い発泡体１２３を充填する方法では発泡体１２３を希望位置に位置決めするのが難しく、中空構造物１２０の補強効率が低い。また、補強板１２４を挟んで溶接する方法では幅方向の強度に対して縦方向の強度が低くなり、やはり中空構造物１２０の補強効率が低い。
【０００４】本発明は、上記問題点に鑑みなされたものであり、従来よりも効率的に中空構造物を補強できる補強具の提供を目的とする。
【０００５】
【課題を解決するための手段】上記した課題は、各請求項の発明によって解決される。請求項１の発明によると、補強部材の仕切り壁によって中空構造物の中空部はその横断面において複数の分割室に仕切られる。さらに、複数の分割室のうち少なくとも一つの分割室は発泡性基材が発泡して発泡体となることで遮断される。このため、中空構造物は複数の分割室及び発泡体の働きで幅方向及び縦方向にほぼ均等に補強される。また、発泡性基材は分割室内で発泡するため、発泡体の位置決めも容易になる。即ち、中空構造物は分割室及び発泡体により内側から効率的に補強される。
【０００６】請求項２の発明によると、発泡性基材は発泡して発泡体となることで中空構造物の内壁面と補強部材とを結合させるため、中空構造物と補強部材との間でガタが発生しない。
【０００７】請求項３の発明によると、複数の分割室を遮断するための発泡性基材のうち少なくとも一つの発泡性基材は、他の発泡性基材と異なる種類である。このため、例えば、中空構造物の補強のみならず、耐振性の向上や遮音性の向上を図ることも可能になる。
【０００８】請求項４の発明によると、補強部材の仕切り壁によって中空構造物の中空部を横断面において複数の分割室に仕切り、さらに横壁によって中空部を縦断面において複数の分割室に仕切るため、中空構造物を長手方向、幅方向にバランス良く補強することができる。
【０００９】請求項５の発明によると、補強部材はその横断面において複数に分割された分割体により構成されるため、その補強部材の横断面形状が複雑な場合には、補強部材を一体成形するよりも製作が容易になる。さら

に、中空構造物が長手方向に湾曲する場合等でもその中空構造物の曲がりに合わせて補強部材を成形できるようになる。

【００１０】請求項６の発明によると、補強部材はその横断面の形状が略格子形であるため、中空構造物の横断面形状に係らずバランス良く補強を行える。

【００１１】請求項７の発明によると、補強部材の仕切り壁によって中空構造物の中空部はその横断面において複数の分割室に仕切られる。さらに、複数の分割室のうち少なくとも一つの分割室は発泡性基材が発泡して発泡体となることにより遮断される。このため、中空構造物は複数の分割室及び発泡性基材の働きにより、内側から効率的に補強される。

【００１２】

【発明の実施の形態】（第一の実施の形態）以下、図１～図３に基づいて、本発明の第一の実施の形態に係る中空構造物の補強具の説明を行う。本実施の形態に係る中空構造物の補強具は、車両ボディのピラー、ロッカーパネル、ルーフサイドパネル等の中空構造物の補強具に関する。ここで、図１（Ａ）は補強具を中空構造物に取付けた状態を表す斜視図、図１（Ｂ）はその補強具の要部斜視図、図２（Ａ）は図１（Ａ）のIIA- IIA矢視断面図、図２（Ｂ）は図２（Ａ）のB-B矢視断面図である。また、図３（Ａ）は発泡性基材が発泡した後の図１（Ａ）のIIA- IIA矢視断面図、図３（Ｂ）は図３（Ａ）のB-B矢視断面図である。

【００１３】中空構造物１は、図１（Ａ）に示されるように、断面略台形状のインナーパネル２とアウターパネル３とから構成されており、そのインナーパネル２とアウターパネル３とが互いのフランジ部２ｆ，３ｆでスポット溶接されることにより、断面略六角形状の中空部６が形成される。また、中空構造物１の中空部６内には所定位置にその中空構造物１を補強する補強具２０が取付けられる。

【００１４】補強具２０は、中空構造物１の変形を防ぐためにその中空構造物１を内側から補強する所定長さ寸法の補強部材２１を備えている。補強部材２１は、図１（Ｂ）に示されるように、中空構造物１の長手方向に延びる一対の横仕切り壁２１ａと一対の縦仕切り壁２１ｂとが格子状に組み合わされることにより成形される。このように、横仕切り壁２１ａと縦仕切り壁２１ｂとが格子状に組み合わされるため、補強部材２１の中央には長手方向に角筒部２４が形成され、その角筒部２４の周囲に四個のＵ字溝部２５と四個のＬ字溝部２６とが形成される。

【００１５】そして、その補強部材２１が中空構造物１に収納されることにより、図１（Ａ）に示されるように、中空構造物１の内部には補強部材２１の角筒部２４による中央分割室Ｓｃと、補強部材２１のＵ字溝部２５、Ｌ字溝部２６による八個の周囲分割室Ｓｒとが形成される。即ち、中空構造物１の中空部６は補強部材２１によって長手方向に延びる中央分割室Ｓｃとその中央分割室Ｓｃの回りに形成された八個の周囲分割室Ｓｒとに分割される。

【００１６】補強部材２１の角筒部２４の周囲には長手方向所定位置にＵ字溝部２５、Ｌ字溝部２６を横断する一対のホルダプレート２７がフランジ状に固定されている。そして、それらのホルダプレート２７とＵ字溝部２５、あるいはＬ字溝部２６とによって画成される各々の凹部に後記する発泡性基材３０がセットされる。ホルダプレート２７は発泡性基材３０が中空構造物１の横断方向に発泡膨張するように発泡方向を規制する部材であり、その所定位置に発泡性基材３０を固定する係合部材（図示されていない）が装着されている。

【００１７】ホルダプレート２７はその外形が中空構造物１の中空部６の横断面形状とほぼ等しい形状に成形されており、その寸法は中空部６の内周壁面との間に適宜の隙間（塗料が通過できる程度の隙間）が生じる寸法に設定されている（図２（Ａ），（Ｂ）参照）。

【００１８】補強部材２１の下端部には、長手方向両側にその補強部材２１をインナーパネル２の取付け孔２ｋに固定するための係止クリップ２９が形成されている。係止クリップ２９は、図２（Ａ）に示されるように、補強部材２１の縦仕切り壁２１ｂに接続された台座部２９ｄと、その台座部２９ｄの下面から突出してインナーパネル２の取付け孔２ｋの心方向に延びる脚部２９ａと、その脚部２９ａの先端部両側から折り返し状に延出して取付け孔２ｋと弾性的に係合する弾性係止片２９ｔとを備えている。ここで、インナーパネル２の取付け孔２ｋ及び補強部材２１の係止クリップ２９の位置は、補強部材２１の角筒部２４が中空構造物１の中空部６とほぼ同心となる位置に設定される。なお、図２（Ａ）には、係止クリップ２９を補強部材２１の長手方向両側に形成した例を示したが、補強部材２１の支持バランスを考慮して途中位置に適宜形成しても良い。

【００１９】補強部材２１、ホルダプレート２７及び係止クリップ２９等は一般的に樹脂の射出成形により一体成形される。なお、補強部材２１は横断面において複数に分割された分割体により構成しても良い。ここで、補強部材２１等の材料としては、耐熱性を有する硬質合成樹脂、望ましくは強化繊維が混入された硬質合成樹脂が好適に使用される。硬質合成樹脂としては、例えば、ポリアミド（ＰＡ）、ポリプロピレン（ＰＰ）、ポリエチレンテレフタレート（ＰＥＴ）、ポリブチレンテレフタレート（ＰＢＴ）、エポキシ（ＥＰ）、不飽和ポリエステル樹脂等が用いられる。また、強化繊維としては、例えば、ガラス繊維、カーボン繊維、ケプラー繊維等が用いられる。さらに、硬質合成樹脂に対する強化繊維の混入割合は、30～40重量％に設定される。即ち、補強部材２１のホルダプレート２７が本発明の横壁に相当する。

【００２０】発泡性基材３０は、発泡して発泡体４０となることで八個の周囲分割室Ｓｒを遮断する部材であり、補強部材２１のU字溝部２５、Ｌ字溝部２６と一対のホルダプレート２７とによって画成される各々の凹部に嵌合できる形状に成形されている。また、発泡性基材３０の材料としては、金属面や合成樹脂面に対し接着性を有する合成樹脂を主成分とし、これに発泡剤、ガラス繊維のような強化用の繊維状物質等が混合され、車両ボディの焼付け塗装の際の熱（例えば、110℃～190℃前後の温度）によって発泡し、高剛性の発泡体４０となる発泡性材料が好適に使用される。

【００２１】次に、中空構造物１を補強する手順について説明する。先ず、補強部材２１と一体に成形された一対のホルダプレート２７間の凹部に各々の発泡性基材３０がセットされて補強具２０が構成される（図１（Ｂ）参照）。次に、補強具２０の係止クリップ２９がインナーパネル２の取付け孔２ｋに嵌め込まれ、補強具２０がインナーパネル２の所定位置に固定される。

【００２２】次に、インナーパネル２とアウターパネル３とが互いのフランジ２ｆ，３ｆにおいてスポット溶接され、図１（Ａ）に示されるように、断面略六角形状の中空構造物１が形成される。この状態で、中空構造物１の中空部６には所定位置に補強具２０がその中空部６とほぼ同心となるように取付けられ、その補強具２０のホルダプレート２７及び発泡性基材３０と中空部６の内周壁面との間には塗料が通過できる程度の隙間が形成される（図２（Ａ），（Ｂ）参照）。

【００２３】このようにして、中空構造物１を有する車両のボディが成形されると、そのボディが焼付け塗装される。そして、その焼付け塗装の際の外部加熱によって、補強具２０の各々の発泡性基材３０が、図３（Ａ）（Ｂ）に示されるように、発泡膨張して発泡体４０となる。発泡性基材３０はホルダプレート２７によって両側から挟持されているため、その発泡性基材３０はホルダプレート２７に沿う方向の発泡が効果的に促進される。即ち、ホルダプレート２７は発泡方向をコントロールする働きもあるため、発泡体の充填効率もコントロールできる。

【００２４】発泡体４０は補強具２０の補強部材２１及びホルダプレート２７に接着されるとともに、そのホルダプレート２７から押出された発泡体４０はホルダプレート２７と中空構造物１の内周壁面との隙間を塞いでその内周壁面に強固に接着される。即ち、補強具２０によって中空構造物１の中空部６に形成された周囲分割室Ｓｒは発泡体４０によって遮断され、補強具２０はその発泡体４０によって中空構造物１に結合される。なお、補強具２０の角筒部２４の働きにより中央分割室Ｓｃには発泡体４０が入り込むことはない。

【００２５】このように、本実施の形態に係る中空構造物１の補強具２０によると、補強部材２１の仕切り壁２１ａ，２１ｂによって中空構造物１の中空部６はその横断面において複数の分割室Ｓｃ，Ｓｒに仕切られる。さらに、複数の分割室Ｓｃ，Ｓｒのうち周囲分割室Ｓｒは発泡性基材３０が発泡して発泡体４０となることで遮断される。このため、中空構造物１は複数の分割室Ｓｃ，Ｓｒ及び発泡体４０の働きで幅方向及び縦方向にほぼ均等に補強される。また、発泡性基材３０はホルダプレート２７で両側から拘束された状態で周囲分割室Ｓｒ内で発泡するため、発泡体４０の位置決めも容易になる。即ち、中空構造物１は分割室Ｓｃ，Ｓｒ及び発泡体４０により内側から効率的に補強される。

【００２６】また、補強具２０の発泡性基材３０は発泡して発泡体４０となることで中空構造物１の内壁面と補強部材２１等とを結合させるため、中空構造物１と補強部材２１との間でガタが発生しない。また、補強部材２１の仕切り壁２１ａ，２１ｂによって中空構造物１の中空部６を横断面において複数の分割室Ｓｃ，Ｓｒに仕切り、さらにホルダプレート２７によって中空部６を縦断面において複数の分割室に仕切るため、中空構造物１を長手方向、幅方向にバランス良く補強することができる。

【００２７】また、補強部材２１はその横断面の形状が略格子形であるため、中空構造物１の横断面形状に係らずバランス良く補強を行える。また、補強部材２１は樹脂製であるため、鉄板等の補強板と比べると軽く、さほど重量増加にならない。なお、本実施の形態では断面略六角形状の中空構造物１における補強具について説明したが、中空構造物１の断面形状は略六角形以外に略四角形、五角形、楕円形等であっても良い。

【００２８】（第二の実施の形態）以下、図４に基づいて、本発明の第二の実施の形態に係る中空構造物の補強具の説明を行う。本実施の形態に係る中空構造物の補強具は、第一実施の形態における発泡性基材の配置を変更したものであり、その他の構造は第一実施の形態の場合と同様である。本実施の形態に係る補強部材６０は、角筒部６４の周囲所定位置にU字溝部６５、Ｌ字溝部６６を横断する平行な三枚のホルダプレート６７を備えている。そして、それらのホルダプレート６７とU字溝部６５、あるいはL字溝部６６とによって画成される複数の凹部のうち予め決められた凹部に第一の発泡性基材７２が収納されている。

【００２９】即ち、本実施の形態においては、図４（Ａ）において手前のホルダプレート６７と中央のホルダプレート６７との間では、図４（Ｃ）に示される凹部の位置に第一の発泡性基材７２が収納される。また、中央のホルダプレート６７と後方のホルダプレート６７との間では、図４（Ｃ）の状態から周方向に一区画ずれた状態で第一の発泡性基材７２が収納される。このように、第一の発泡性基材７２が中空構造物１の長手方向に分散されるため、図示されていない発泡体により補強部

材６０を中空構造物１に固定する際のバランスが向上する。ここで、第一の発泡性基材７２の材料としては、第一の実施の形態で使用された発泡性基材３０と同じ材料が使用される。

【００３０】また、補強部材６０の角筒部６４の内部には、図４（Ｂ），（Ｃ）に示されるように、第二の発泡性基材７４が収納される。第二の発泡性基材７４は第一の発泡性基材７２よりも高倍率で発泡する発泡性基材であり、その発泡体（図示されていない）は第一の発泡性基材７２による発泡体（図示されていない）よりも格段に比重が小さく、さらに強度も小さい。しかし、その第二の発泡性基材７４による発泡体で補強部材６０の角筒部６４の内部が塞がれることにより、中空構造物１の遮音効果が向上する。また、第二の発泡性基材７４の発泡体は第一の発泡性基材７２の発泡体よりも比重が格段に小さいため、角筒部６４に発泡体を充填してもさほど重量が増加しない。

【００３１】なお、本実施の形態では、三枚のホルダプレート６７を使用して第一の発泡性基材７２を中空構造物１の長手方向に分散させる例を示したが、複数組のホルダプレートを使用して各組毎にホルダプレートを長手方向に離した状態で第一の発泡性基材７２を分散させる方法でも可能である。

【００３２】（第三の実施の形態）以下、図５に基づいて、本発明の第三の実施の形態に係る中空構造物の補強具の説明を行う。本実施の形態では、補強部材の長手方向に直角な断面形状を、図５（Ａ）、（Ｂ）に示されるように、簡易格子形に変更したものであり、その他の構造は第一実施の形態に係る中空構造物の補強具と同様である。このように、補強部材８０の断面形状が簡易格子形になるため、その補強部材８０の軽量化及びコスト低減を図ることができる。

【００３３】また、補強部材８０は、樹脂の射出成形により一体成形しても良いし、図５（Ｃ）、（Ｄ）に示されるように、横断面において複数に分割された分割体８１，８２，８３をそれぞれ成形し、中空構造物にセットする際にそれらの分割体８１，８２，８３を接着剤や溶着等により組み立てても良い。さらに、補強部材８０の横断面形状が複雑で射出成形が不可能な場合でも、分割体８１，８２，８３から組み立てることで、補強部材８０の製作が可能になる。また、分割体８１，８２，８３から補強部材８０を組み立てることにより、中空構造物が長手方向に湾曲する場合等でも、その中空構造物の曲がりに合わせて補強部材８０を成形することが可能となる。なお、図５（Ｄ）に示されるように、断面Ｔ字形の分割体８３を二個組み合わせて補強部材８０を形成するほうが、図５（Ｃ）に示されるように、異なる形状の分割体８１，８２から補強部材８０を形成するよりも在庫管理上好ましい。

【００３４】（第四の実施の形態）以下、図６に基づいて、本発明の第四の実施の形態に係る中空構造物の補強具の説明を行う。本実施の形態に係る中空構造物の補強具は、補強部材の格子の数を増加させて中央分割室を囲む周囲分割室の数を増やし、周囲分割室に種々の発泡性基材を収納できるようにしたものである。

【００３５】補強部材１００は八枚の横板１０１～１０８と六枚の縦板１１１～１１６とが格子状に組み合わされることにより成形される。そして、第二横板１０２、第五横板１０５、第三縦板１１３及び第四縦板１１４により画成される中央分割室Ｓｃに第二実施の形態で使用された高倍率で発泡する高倍率発泡性基材７４の薄板がセットされる。

【００３６】第一横板１０１、第六横板１０６、第一縦板１１１及び第六縦板１１６の外側には制振性の高い（比較的弾性を有する）発泡体が得られる制振発泡性基材１１７がセットされる。また、中央分割室Ｓｃを所定の厚みで囲む分割室、即ち、第一横板１０１、第六横板１０６、第二縦板１１２及び第五縦板１１５の内側にある分割室であって中央分割室Ｓｃの外側にある第一周囲分割室Ｓａには、高剛性の発泡体が得られる高剛性発泡性基材１１８がセットされる。

【００３７】第一周囲分割室Ｓａの外側で第一縦板１１１の内側に位置する第二周囲分割室Ｓｂには発泡時に激しく発熱する発熱発泡性基材１１９がセットされる。また、第一周囲分割室Ｓａの外側で第六縦板１１６の内側に位置する第三周囲分割室Ｓｃにも発熱発泡性基材１１９がセットされる。

【００３８】そして、中空構造物を有する車両のボディが焼付け塗装される際の外部加熱によって、各々の発泡性基材７４，１１７，１１８，１１９が発泡膨張する。即ち、第一横板１０１、第六横板１０６、第一縦板１１１及び第六縦板１１６の外側に位置する制振発泡性基材１１７が発泡すると、その発泡体によって補強部材１００と中空構造物の内壁面との間の分割室が塞がれ、補強部材１００が中空構造物（図示されていない）に接着されるとともに、その発泡体によって中空構造物に加わる振動をある程度吸収できるようになる。また、中央分割室Ｓｃに位置する高倍率発泡性基材７４が発泡することにより、その発泡体によって中央分割室Ｓｃが塞がれ、さほど重量のアップを伴なわずに中空構造物の遮音効果を向上させることができる。

【００３９】さらに、中央分割室Ｓｃを囲む第一周囲分割室Ｓａに位置する高剛性発泡性基材１１８が発泡することにより、その発泡体によって第一周囲分割室Ｓａが塞がれ、補強部材１００の剛性が向上する。また、第二周囲分割室Ｓｂ及び第三周囲分割室Ｓｃに位置する発熱発泡性基材１１９が発泡することによりその発熱発泡性基材１１９が発熱し、その発熱により焼付け塗装の際の加熱温度が低くても制振発泡性基材１１７、高倍率発泡性基材７４及び高剛性発泡性基材１１８を良好に発泡さ

せることができる。

【００４０】なお、本実施の形態においては、高剛性発泡性基材１１８及び発熱発泡性基材１１９の外側に制振発泡性基材１１７を配置する例を示したが、高剛性発泡性基材１１８と制振発泡性基材１１７とを入れ替えても良い。また、高剛性発泡性基材１１８、発熱発泡性基材１１９及び制振発泡性基材１１７を互い違いに配置することも可能である。さらに、第一から第三実施の形態においては、固形の発泡性基材を使用する例を示したが、補強部材の格子により形成される分割室に蓋を装着できるようにすれば、粉末、粒体あるいは液体の発泡性基材を使用することも可能である。これによって、発泡性基材の成形精度を考慮する必要がなくなる。

【００４１】また、第一から第四実施の形態では車両ボディのロッカーパネル、ルーフサンドパネル等の中空構造物に本発明の補強具を使用する例を示したが、車両ボディ以外、例えば、建築物、船舶等の建造物を構成する中空構造物に本発明の補強具を使用することも可能である。

【００４２】なお、第一の実施の形態から第四の実施の形態により把握される発明であって特許請求の範囲に記載されていない発明を以下に追記する。

１）　請求項３において、補強部材の内部に収納される発泡性基材は中空構造物の内壁面と補強部材とを結合させるための発泡性基材よりも高倍率で発泡する。このため、補強部材の内部の発泡体の比重が小さくなり、さほど重量アップを伴なわずに中空構造物の遮音効果を向上させることができる。

２）　請求項３において、複数の分割室を遮断するための発泡性基材のうち少なくとも一つの発泡性基材は、他の発泡性基材よりも発泡時における発熱性が高い。このため、焼付け塗装の際の加熱温度が低くても他の発泡性基材を良好に発泡させることができる。

３）　請求項３において、複数の分割室を遮断するための発泡性基材のうち少なくとも一つの発泡性基材は、他の発泡性基材よりも得られた発泡体の剛性が高い。このため、補強部材の剛性が向上する。

４）　請求項３において、複数の分割室を遮断するための発泡性基材のうち少なくとも一つの発泡性基材は、他の発泡性基材よりも得られた発泡体の弾力性が大きい。このため、中空構造物に加わる振動をある程度吸収できる。

５）　請求項４において、発泡して発泡体となることで、複数の分割室のうち少なくとも一つの分割室を遮断する発泡性基材を備えている。このため、補強部材及び発泡体により、中空構造物を長手方向、幅方向にバランス良く補強できる。

【００４３】

【発明の効果】本発明によると、中空構造物は複数の分割室及び発泡体の働きで幅方向及び縦方向にほぼ均等に補強される。さらに、発泡性基材は分割室内で発泡するため、発泡体の位置決めも容易になる。即ち、中空構造物は分割室及び発泡体により内側から効率的に補強される。

【図面の簡単な説明】

【図１】本発明の第一の実施の形態に係る中空構造物の補強具の取付け状態を表す斜視図（Ａ図）、補強具の要部斜視図（Ｂ図）である。

【図２】図１（Ａ）のIIA -IIA矢視断面図（Ａ図）、Ａ図のB-B矢視断面図（Ｂ図）である。

【図３】発泡後の状態を表す図１（Ａ）のIIA -IIA矢視断面図（Ａ図）、Ａ図のB-B矢視断面図（Ｂ図）である。

【図４】本発明の第二の実施の形態に係る中空構造物の補強具の要部斜視図（Ａ図）、中空構造物に取付けた状態を表す縦断面図（Ｂ図）、Ｂ図のC-C矢視断面図（Ｃ図）である。

【図５】本発明の第三の実施の形態に係る中空構造物の補強具における補強部材の横断面形状図（Ａ図、Ｂ図）、補強部材を構成する分割体の横断面形状図（Ｃ図、Ｄ図）である。

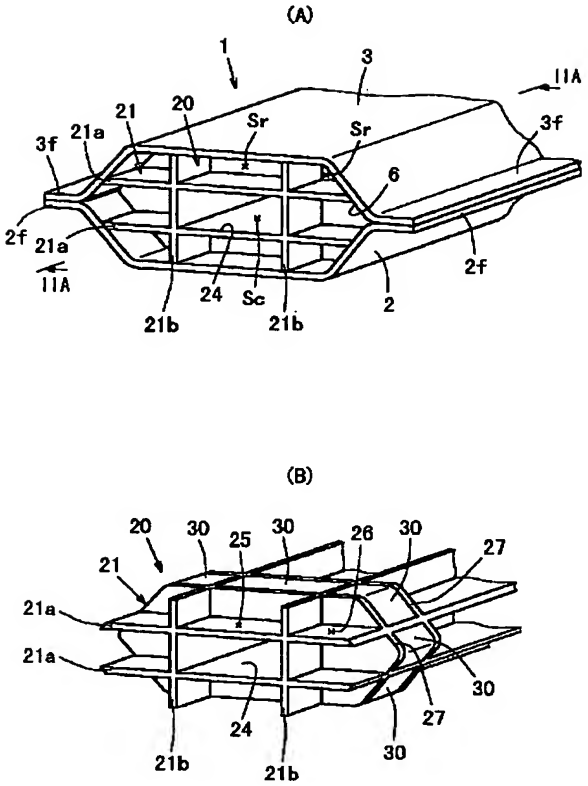
【図６】本発明の第四の実施の形態に係る中空構造物の補強具における横断面形状図である。

【図７】従来の中空構造物の斜視図（Ａ図）、及び中空構造物に補強具を装着した状態を表す斜視図（Ｂ図、Ｃ図）である。

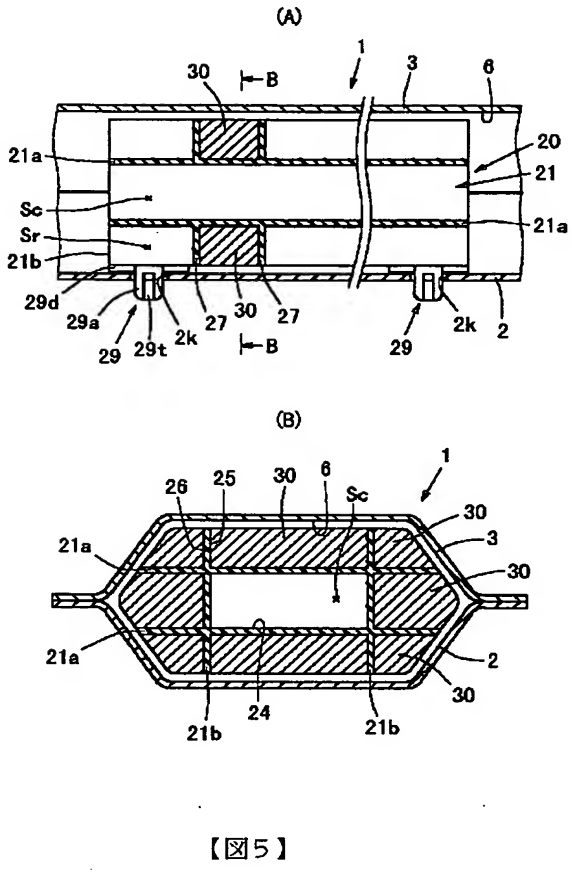
【符号の説明】

Ｓｃ	中央分割室
Ｓｒ	周囲分割室
１	中空構造物
２０	補強具
２１	補強部材
２１ａ	横仕切り壁
２１ｂ	縦仕切り壁
２７	ホルダプレート（横壁）
３０	発泡性基材
４０	発泡体
７４	高倍率発泡性基材
１１７	制振発泡性基材
１１８	高剛性発泡性基材
１１９	発熱発泡性基材

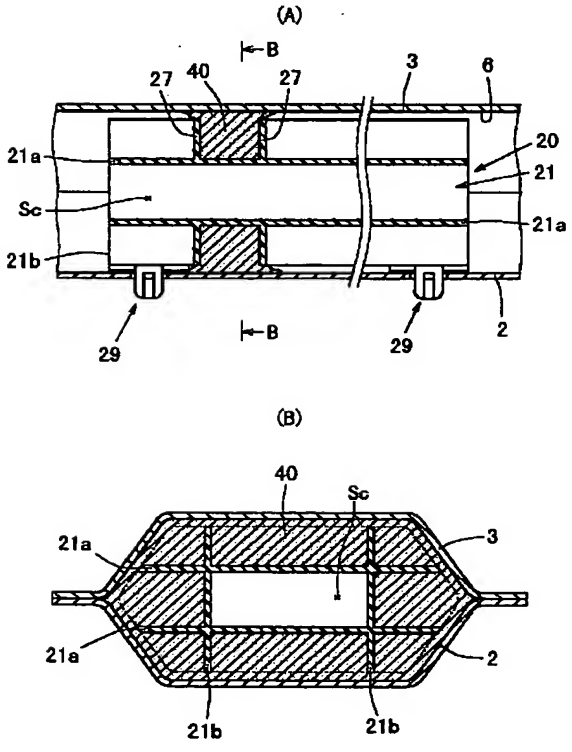
【図1】



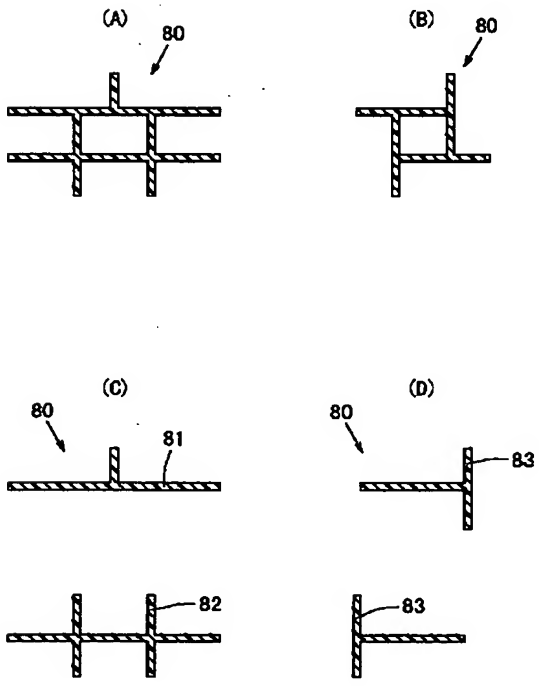
【図2】



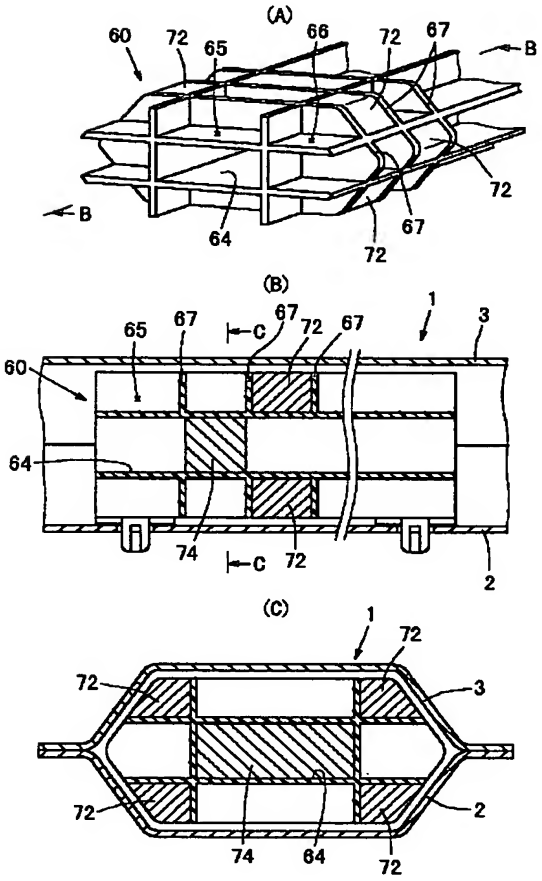
【図3】



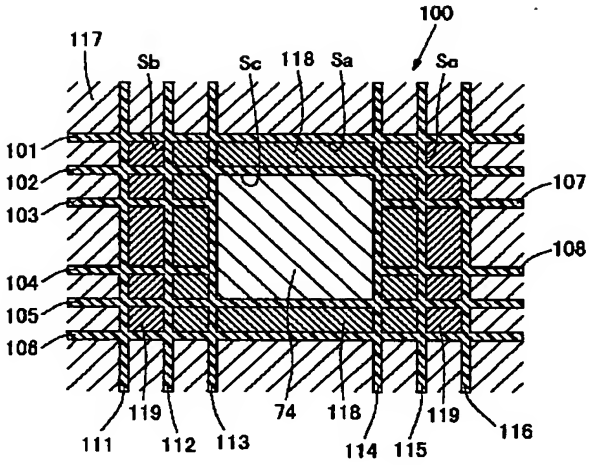
【図5】



【図4】



【図6】



【図7】